

# **BUREAU OF WATER**

South Carolina Department of Health and Environmental Control

## **SHELLFISH MANAGEMENT AREA 20**

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### **2003 ANNUAL UPDATE**

#### **Shellfish Sanitation Program**

Water Monitoring, Assessment and Protection Division  
Environmental Quality Control - Bureau of Water  
2600 Bull Street  
Columbia, South Carolina 29201

July 2003



**WEB ADDRESS:**  
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# 2003 ANNUAL UPDATE

[ Data Thru December 2002 ]

## Shellfish Management Area 20 Shellfish Sanitation Program



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**ANNUAL UPDATE**  
**Shellfish Management Area 20**  
**SCDHEC EQC Bureau of Water**

**Data Inclusive Dates:**

01/01/00 thru 12/31/02

**Classification Change:**

     Yes   X   No

**Shoreline Survey Completed:**   Yes  

**(I)ncreased/(D)ecreased/(N)one:**

  N   Approved

  N   Conditionally Approved

  N   Restricted

  N   Prohibited

**Prior Report & Date:** Annual -2002

**SUMMARY**

The majority of sampling stations in Shellfish Management Area 20 exhibited lower geometric mean and/or 90th percentile values subsequent to the previous sanitary survey. Drought conditions within the area during this review period have resulted in below normal rainfall and associated runoff. This has resulted in higher than normal salinities within the growing area and appears to have contributed to low fecal coliform bacteria concentrations.

The Town of Hilton Head installed a kiosk at the Marshland Road boat landing on Broad Creek. A harvest classification map of the Broad Creek area, an Open/Closed sign for the Conditionally Approved area, and other shellfish harvesting information is included.

The Jarvis Creek Park opened to the public on May 5, 2003. Stormwater from the Main Street and Hilton Head Plantation areas will be pumped up into the 11- acre lake where sediment will settle out. The water then flows through a man-made wetland, which absorbs substances such as nitrogen and phosphorus, before reaching Jarvis Creek.

Maintenance dredging is being performed at Harbour Town Marina, Gull Point Marina, and South Beach Marina, and in Baynard Cove Creek and Braddock Creek.

Sampling at Station 15, Broad Creek at Lawton Creek, was discontinued in November 2002 as the station was located within the administratively Prohibited closure zone for the South Island PSD wastewater treatment plant discharge. Two new stations, 28 and 29, were created in Broad Creek at the northern and southern boundaries of the closure zone. These stations will be included in the list of stations used to reopen the Broad Creek Conditionally Approved area following a closure.

Stormwater appears to adversely affect shellfish water quality within portions of Area 20. The Town of Hilton Head is continuing to incorporate measures to protect water quality into its drainage improvement projects. With increased development, central sewer is replacing septic tanks as the primary method of wastewater treatment and disposal for the majority of new structures in Area 20.

## INTRODUCTION

### PURPOSE AND SCOPE

The authority to regulate the harvest, sanitation, processing and handling of shellfish is granted to the South Carolina Department of Health and Environmental Control by Section 44-1-140 of the Code of Laws of South Carolina, 1976, as amended. The Department promulgated Regulation 61-47 that provides the rules used to implement this authority and outlines the requirements applied in regulating shellfish sanitation in the State. This regulation specifically addresses classification of shellfish harvesting areas and requires that all areas be examined by sanitary and bacteriological surveys and classified into an appropriate shellfish harvesting classification.

The National Shellfish Sanitation Program (NSSP) Guide For The Control Of Molluscan Shellfish is used by the United States Food and Drug Administration (USFDA) to evaluate state shellfish sanitation programs. The NSSP Model Ordinance requires that a sanitary survey be in place for each growing area prior to its use as a source of shellfish for human consumption and prior to the area's classification as Approved, Conditionally Approved, Restricted, or Conditionally Restricted. Each sanitary survey shall be updated on an annual basis and accurately reflect changes which have occurred within the area. Requirement of the annual reevaluation include, at a minimum, field observations of pollution sources, an analysis of water quality data consisting of the past year's data in combination with appropriate previously collected data, review of reports and effluent samples from pollution sources, and review of performance standards for discharges impacting the growing area. A brief report documenting the findings shall also be provided.

The following criteria consistent with the NSSP Model Ordinance and S. C. Regulation 61-47 are used in establishing shellfish harvesting classifications:

**Approved** - Growing areas shall be classified Approved when the sanitary survey concludes that fecal material, pathogenic microorganisms, and poisonous or deleterious substances are not present in concentrations which would render shellfish unsafe for human consumption. The Approved area classification shall be designated based upon a sanitary survey which includes water samples collected from stations in the designated area adjacent to actual or potential sources of pollution. For waters sampled under adverse pollution conditions, the median fecal coliform Most Probable Number (MPN) or the geometric mean MPN shall not exceed fourteen per one hundred milliliters, and not more than ten percent of the samples shall exceed a fecal coliform MPN of forty-three per one hundred milliliters (per five tube decimal dilution). For waters sampled under a systematic random sampling plan, the geometric mean fecal coliform Most Probable Number (MPN) shall not exceed fourteen per one hundred milliliters, and the estimated ninetieth percentile shall not exceed an MPN of forty three (per five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP Guidelines.

**Conditionally Approved** - Growing areas may be classified Conditionally Approved when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river, or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be adopted by the Department prior to classifying an area as Conditionally Approved. Where

appropriate, the management plan for each Conditionally Approved area shall include performance standards for sources of controllable pollution, e.g., wastewater treatment and collection systems, evaluation of each source of pollution, and means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate.

**Restricted** - Growing areas shall be classified Restricted when sanitary survey data show a limited degree of pollution or the presence of deleterious or poisonous substances to a degree which may cause the water quality to fluctuate unpredictably or at such a frequency that a Conditionally Approved classification is not feasible. Shellfish may be harvested from areas classified as Restricted only for the purposes of relaying or depuration and only by special permit issued by the Department and under Department supervision. For Restricted areas to be utilized as a source of shellstock for depuration, or as source water for depuration, the fecal coliform geometric mean MPN of restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters and not more than ten percent of the samples shall exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters and the estimated ninetieth percentile shall not exceed an MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP guidelines.

**Conditionally Restricted** - Growing areas may be classified Conditionally Restricted when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river, or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be prepared by the Department prior to classifying an area as Conditionally Restricted. Where appropriate, the management plan for each Conditionally Restricted area shall include performance standards for sources of controllable pollution (e.g., wastewater treatment and collection systems and an evaluation of each source of pollution) and description of the means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate. Shellfish may be harvested from areas classified as Conditionally Restricted only for the purposes of relaying or depuration and only by permit issued by the Department and under Department supervision. For Conditionally Restricted areas to be utilized as a source of shellstock for depuration, the fecal coliform geometric mean MPN of Conditionally Restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters and not more than ten percent of the samples shall exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters and the estimated ninetieth percentile shall not exceed an MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP guidelines.

**Prohibited** - Growing areas are classified Prohibited if there is no current sanitary survey or if the sanitary survey or monitoring data show unsafe levels of fecal material, pathogenic microorganisms, or poisonous or deleterious substances in the growing area or indicate that such substances could potentially reach quantities which could render shellfish unfit or unsafe for human consumption.

## **BACKGROUND INFORMATION**

Shellfish Management Area 20 consists of approximately 22,448 acres of shellfish growing area habitat in Beaufort County. It is comprised of Calibogue Sound and its tributaries including Skull, Mackay, Jarvis, Old House, and Broad Creeks. The area's northern boundary begins near the Colleton River and follows the shoreline of Port Royal Sound, crosses the mouth of Mackay and Skull Creek, and continues to the Atlantic Ocean. The eastern boundary and southern boundaries are defined by the Atlantic Ocean. The western boundary extends northward through the lower portions of Bull Island and May River.

Although the majority of Area 20 is developed, the Hilton Head Island area is heavily developed with many golf course plantations, shopping malls, restaurants, and marinas. 1995 census data of the island indicates a population of approximately 28,500 permanent residents. During summer months, tourism increases average population to near 70,000. Major holiday periods result in population peaks of approximately 100,000.

The harvesting classifications of Area 20 prior to this survey were as follows:

### **Prohibited** (Administrative closure):

1. Those waters adjacent to Harbor Town marina and 1000 feet northeast and southeast; 1000 feet adjacent to Moss Creek marina; 1000 feet adjacent to Skull Creek Marina; 1000 feet adjacent to Outdoor Resorts marina; 1000 feet adjacent to Windmill Harbor marina, 1000 feet adjacent to South Beach marina including area within line from offshore edge of South Beach Marina closure zone to the offshore edge of Harbor Town marina closure zone;
2. Those waters adjacent to Palmetto Bay marina 100 feet north to the unnamed creek adjacent to Spanish Wells Plantation, extending west to the oyster bank and southward to include the docking area of Haig Point embarkation;
3. Those waters around Shelter Cove marina 1000 feet northeast and southeast from the mouth of the harbor to the oyster bank on the opposite side;
4. Those waters around Wexford Harbor from the unnamed island that extends northeast along Broad Creek to the shoreline northwest of Wexford on the opposite side;
5. Those waters adjacent to Broad Creek marina to 1000 feet south, extending eastward across Broad Creek to the oyster bank and 1000 feet north adjacent to the private docks;
6. Those waters adjacent to the boat docking facilities at Villages on Skull Creek, Hilton Head Plantation, Long Cove, Baynard Cove, Gull Point community, and Schillings Boat House;
7. Those waters in Broad Creek adjacent to the Sea Pines outfall 1000 feet north and south of the mouth of Lawton Creek;
8. Folly Creek, the entire tributary to its confluence with the Atlantic Ocean.

**Restricted / No Depuration:** None

### **Restricted:**

1. Broad Creek, from the boundary of the Conditionally Approved area at Station 25, to the headwaters, including Station 16;
2. Fish Haul Creek, from its headwaters to its confluence with Port Royal Sound.

**Conditionally Approved:**

Broad Creek, from Station 03 to Station 25 (excluding all Administratively Prohibited closure zones). The Conditionally Approved area will consist only of the main channel of Broad Creek between stations 04A and 17B, excluding the closure zones. Between stations 17B and 25, the Conditionally Approved area will consist of Broad Creek proper and the adjacent marshes, excluding all closure zones.

**Approved:** The remaining waters of Area 20.

**Station Addition/Deactivation/Modification:** None

The shellfish industry in South Carolina is based mainly on the harvest of the eastern oyster (*Crassostrea virginica*) and hard clams (*Mercenaria mercenaria*).

Areas in South Carolina designated for commercial harvest by the South Carolina Department of Natural Resources (SCDNR) include state shellfish grounds, culture permits, and Kings Grant areas. There are ten shellfish culture permit areas in Area 20. The general public is allowed to harvest on three state shellfish grounds in Area 20. State shellfish ground 005 is located on Haig Point; 029 is located in Jarvis Creek; and 048 is at the northern end of Hilton Head Island, beginning at the mouth of Skull Creek and extending into Port Royal Sound. Recreational harvesting is allowed for clams and oysters in all areas, and commercial harvesting by licensed individuals is allowed, subject to seasons established by SCDNR. Recreational harvesting only is allowed on the Last End Point Public Shellfish Ground R-036).

Shellfish harvesting season in South Carolina extends from September 16 through May 15, although actual dates may vary. SCDNR has the authority to alter the shellfish harvest season for management purposes. The South Carolina Department of Health and Environmental Control has the authority to prohibit shellfish harvesting when necessary to ensure that all shellfish harvested in South Carolina waters are safe for human consumption.

## **POLLUTION SOURCE SURVEY**

### **SURVEY PROCEDURES**

Shoreline surveys of Area 20 were conducted by the Low Country District Shellfish Sanitation staff during the survey period and are ongoing.

### **POINT SOURCE POLLUTION**

Major sources of actual or potential pollution (see Figure 3):

<b>PERMITTED FACILITIES</b>	<b>PERMIT #/TYPE/ DISCHARGE</b>
Water Oaks Utilities/ Moss Creek WWTP	ND0014567/ 0.179 MGD/spray irrigation



Hilton Head PSD # 1	ND0065854/ 1.0 MGD/spray irrigation
Hilton Head PSD # 1/Hilton Head Plantation	SC0043605/ 0.5MGD and 0.15MGD/2 wetlands
Hilton Head PSD # 1/ Palmetto Hall	SC0046191/ 3.2 MGD/ wetlands
Hilton Head PSD# 1	ND0068462/ 3.2 MGD/ spray irrigation
Broad Creek PSD	ND0063100/ 2.085MGD/ spray irrigation
South Island PSD/ Long Cove WWTP	ND0013528/ 0.225 MGD/ spray irrigation
South Island PSD/ Wexford WWTP	ND0017141/ 0.227 MGD/ spray irrigation
South Island PSD / Sea Pines WWTP	ND0064033 / 5.0 MGD/ spray irrigation
South Island PSD / Sea Pines WWTP	SC0042501 / 5.0 MGD/ 2 wetlands
Skull Creek Marina	Marina- with pumpout facilities
Schillings Boathouse	Dry stack marina- no pumpout
Outdoor Resorts marina	Marina-with pumpout
Windmill Harbor marina	Marina- with pumpout
Broad Creek marina	Marina- no pumpout
Shelter Cove marina	Marina- with pumpout
Palmetto Bay marina	Marina- with pumpout
Wexford Lock Harbor	Marina- with pumpout
Harbor Town marina	Marina- with pumpout
South Beach marina	Marina- no pumpout

- A. Municipal and Community Waste Treatment Facilities -** There are no direct discharges of wastewater into Area 20 shellfish waters. Treated effluent is typically used for spray irrigation of golf courses and landscape areas. Wetland areas are also used for disposal of treated effluent, particularly during periods when the golf courses are too wet to use the water. Although the majority of Hilton Head Island residences are served by sewer, some homes continue to utilize septic tanks for wastewater treatment and disposal. Many of the homes adjacent to the northern shore of Broad Creek use septic tanks. South Island PSD reported that a plan is underway to have all of Sea Pines Plantation on sewer within 5 years. South Island PSD has recently finished three sewer projects, providing service to 236 residential lots.

Sewer will be provided to 22 vacant parcels of land (with the potential for up to 90 homes), as well as approximately 48 homes currently utilizing septic tanks in the Muddy Creek Road area. The treated effluent line from Hilton Head PSD #1 WWTP to Indigo Run Plantation is in operation. The flow limits for this outfall (006) are 1.4 MGD and it is used to irrigate two golf courses.

- B. Industrial wastes** -There are no permitted industrial discharges in Area 20.
- C. Marinas** - S.C. Regulation 61-47, Shellfish defines Marina as “any water area with a structure (docks, basin, floating docks, etc.) which is: 1) used for docking or otherwise mooring vessels; and, 2) constructed to provide temporary or permanent docking space for more than ten boats, or has more than 200 linear feet of docking space.” There are ten marinas in Area 20 (see Figure 4). Additionally, there are numerous non-permitted structures that meet the definition of *Marina*. Although these facilities are surrounded by prohibited closures, site-specific sizing has not been determined. These facilities will be surveyed as part of the next shoreline survey.
- D. Radionuclides** - The Savannah River is a potential source of Radionuclides in Area 20. A fish consumption advisory is in effect for Strontium-90 and Cesium-137 in the Savannah River between Beech Island in Aiken County to the Webb Wildlife Center in Hampton County. Radionuclide monitoring of oyster tissue conducted in 1998 and 1999 showed levels for Cesium and Strontium at below detection levels.

#### **NONPOINT SOURCE POLLUTION**

- A. Stormwater** - Hilton Head Island is a coastal barrier island of approximately 22,000 acres. Over the last 40 years, about 16,525 acres have been developed into 11 planned communities and 21 golf courses. The highest point on the island is 28 feet above mean sea level (m.s.l.) with the average being approximately 14 feet above m.s.l. Flooding and stormwater drainage have become critical issues on the island due to the low elevations and relatively flat topography.

Within the planned communities on the island, the stormwater drainage systems typically consist of an arrangement of inter-connecting ditches and lagoons. The majority of the island's stormwater is directed to Broad Creek. Broad Creek receives stormwater from five major drainage systems. They are: the Port Royal Plantation system, Palmetto Dunes, Wexford/Shipyard Plantation, Sea Pines/Lawton canal, and Indigo Plantation. Sampling conducted during the Broad Creek Nonpoint Source Assessment study done in 1995/96 confirmed the presence of high levels of fecal coliforms associated with the low salinity waters of the drainage systems.

In the summer of 1996, The Town of Hilton Head was awarded a Section 319 mini-grant to study nonpoint source pollution in Broad Creek. The study found that correlations of fecal coliform concentrations with salinity and rainfall indicate that the contamination occurs in stormwater runoff rather than from other sources such as sewage discharged from marinas. The report identified two primary NPS pollution inputs to Broad Creek as the headwaters region and Lawton Creek.

Work on the Gum Tree Road project has been completed. The project involves improvements to drainage ditches and construction of a detention pond and creation of a 2-acre wetland.

The Ashmore Tract project is in the final stages of permitting. This area consists of wetlands and forest and has drainage ditches that discharge into the headwaters of Broad Creek at

Matthews Drive. The plans include excavating the ditch channel to its original depth, and installing V-notch weirs to increase detention time of water in the ditch. The tributary ditches behind Hilton Head PSD and near the Santee Cooper power station will be blocked with check dams to increase sheet flow (across the wetland area), percolation, and evaporation. In addition, a bio-retention pond near the fire station will be created to create a natural filter for the stormwater.

The Jarvis Creek Park opened to the public on May 5, 2003. Stormwater from the Main Street and Hilton Head Plantation areas will be pumped up into the 11- acre lake where much of the sediment settles. The water then flows through a man-made wetland, which absorbs substances such as nitrogen and phosphorus, before reaching Jarvis Creek.

The South Forest Beach drainage project has been completed. This project involved cleaning and re-grading the ditch which routes stormwater towards the Sea Pines Forest Preserve. A 11' x 5' box culvert and flow control structure is proposed to replace a 36 inch metal pipe at the entrance road to Hilton Head Preparatory School. The purpose of this project is to maintain the existing water level within the Sea Pines Forest Preserve and satisfy the stormwater needs for Sea Pines Plantation and South Forest Beach.

Work on the Town of Hilton Head drainage improvement project is ongoing. Work is almost completed on the Pineland Station project which drains to Broad Creek.

The former Captain's Seafood site on Matthews Drive has been acquired by the Town of Hilton Head. A wetlands mitigation site is planned to treat stormwater from Matthews Drive prior to discharge to Broad Creek.

The North Forest Beach project involves installing a stormwater collection system in North Forest Beach and maintenance on existing ditches, which transport stormwater through Shipyard Plantation, under Highway 278 to Wexford Plantation and eventually to Broad Creek. Stormwater pumps are to be installed at the discharge point to Broad Creek. Mechanical aeration and vegetation to improve water quality have been proposed for use in this drainage system.

Stormwater runoff impacts water quality by transporting fecal coliform bacteria (and other pollutants) from land to the shellfish growing area. Stormwater from roads, residences, and agricultural land is directed to the lowest point of elevation which is typically the nearest creek or marsh. In addition, there are freshwater wetland areas, ditches, and impoundments which drain into tidal creeks.

Most land disturbing activities in South Carolina must comply with the Stormwater Management and Sediment Reduction Act of 1991. The final regulations, effective on June 26, 1992, establish the procedures and minimum standards for a statewide stormwater management program. For activities in the eight coastal counties, additional water quality requirements are imposed. For all projects, regardless of size, which are located within one-half mile of a receiving water body in the coastal zone, the design criteria for permanent water quality ponds having a permanent pool requires that they store the first 2 inches of runoff from the entire site over a 24-hour period or store the first one inch of runoff from the built-upon portion of the

property, whichever is greater. Storage may be accomplished through retention, detention, or infiltration systems, as appropriate for the specific site. In addition, for those projects which are located within 1000 feet of shellfish beds, the first one and one half inches of runoff from the built-upon portion of the property must be retained on site. Since 1992, these regulations have been applied to the development of residential subdivisions, golf courses, and business areas.

- B. Agricultural Waste** - There are no agriculture operations, i.e., herds of cattle or farming activity in Area 20.
- C. Individual Sewage Treatment and Disposal (ISTD) Systems** - While the majority of Hilton Head Island is served by sewer, some homes still utilize septic tanks for wastewater treatment and disposal. Many of the homes adjacent to the northern shore of Broad Creek use septic tanks.

SCDHEC Environmental Health recently conducted GIS mapping of the location of all septic systems on Hilton Head Island, which shows the locations of those systems which were malfunctioning at the time of the study.

- D. Wildlife and Domestic Animals** - This area supports populations of white-tailed deer, raccoons, wading birds, migratory waterfowl, and other wildlife, which may contribute to fecal coliform levels in some areas. Domestic animals present in the area include dogs, cats, horses, and goats. A waste management plan has been developed for Lawton Stables at Sea Pines Plantation. Implementation of the plan was to be completed by September, 1999.
- E. Boat Traffic** - Calibogue Sound provides access to the Atlantic Ocean for commercial and recreational vessels. The Atlantic Intracoastal Waterway (AIWW) courses through Skull Creek and Calibogue Sound to the Cooper River and eventually to the Savannah River. Tugs and barges, commercial and recreational vessels utilize this North/South route.
- F. Hydrographic and Habitat Modification** - Hydrographic and habitat modification in estuarine areas requires both State and Federal approval. Maintenance dredging is being conducted at the entrance channels to Harbor Town Marina, Baynard Cove and Braddock Creek. Coarse-grained sediments are being used for beach re-nourishment. Fine-grained sediments are to be disposed of at an offshore disposal site.
- G. Marine Biotoxins** - There have been no documented occurrences of toxic algae affecting water quality in Area 20. The Department participates in a State Task Force on Toxic Algae and maintains a toxic algae emergency response team.

## **HYDROGRAPHIC AND METEOROLOGICAL CHARACTERISTICS**

### **PHYSIOGRAPHY**

A tidal node just northeast of May River separates the Broad River estuary and the Savannah River estuary. Skull and Mackey Creeks and their tributaries are part of the Broad River estuary. The Broad River estuary is a drowned river valley system and the largest of Sea Island Coastal Region

estuaries (219 square kilometers). This estuary, which includes Broad River, Beaufort River, Port Royal Sound, and several tidal tributaries, includes an extensive system of marshes, tidal creeks, and sea islands.

The majority of Area 20 is part of the Savannah River estuary, a coastal plain system which includes the New, Wright, and Savannah Rivers and several tributaries of Savannah River (e.g., Front, Back, and Middle Rivers and the South Channel).

The average depth of the estuary is approximately 5 meters at mid-tide level. Navigational channels downstream from Highway 17 in the lower Savannah and Front Rivers range from 9m to 12m in depth and facilitate the intrusion of saltwater into the estuary. The conversion of thousands of acres of saltwater wetlands into diked disposal areas on the South Carolina side could also have altered flow patterns and salinity regimes.

Most tidal exchange occurs through the entrance to Savannah River, primarily through the North Channel; however, limited exchange occurs with the Broad River estuary through Calibogue Sound. The salinity structure is primarily determined by controlled releases of freshwater from impoundments on Savannah River and its tributaries. (NOAA, 1994).

**Tides** - Tides in Area 20 are semidiurnal, consisting of two low and high tides each lunar day. Mean tidal range is 7.0 feet during normal tides and 8.9 feet above mean low water during spring tides.

The greatest tidal ranges of the year typically occur around full moon during the months of September through December. There is considerable variation in the normal tide range due to the prevailing strength and direction of winds.

**Rainfall** - Rainfall data for the period subsequent to February 1998 has been collected at the Broad Creek PSD wastewater treatment plant. Rainfall data prior to that date was collected at weather station 384169 located at Hilton Head Island. This station has discontinued operations.

Mean annual rainfall is approximately 51 inches, with August being the wettest month. A chart showing yearly rainfall amounts for the years 1997 through 2002 is attached. Approximately 40% of the annual rainfall falls in the 3-month period from June to August. Weather patterns during this time period are often characterized by thunderstorms and shower activity of a short duration. In addition, these three months also have the highest numbers of days with rainfall greater than one inch.

The months of December through March historically have the greatest number of days with rainfall exceeding 0.10 inch and 0.50 inch. Rainfall events during these months are typically of a longer duration.

Annual rainfall recorded at the Broad Creek PSD during 2000 and 2001 (see Chart Hilton Head Annual Rainfall) was significantly below the annual norm as averaged over a 30-year period. Below normal rainfall continued through May 2002 and by August 2002, the drought status of all 46 counties in the state, including Beaufort and Colleton, had been upgraded to extreme. Above normal rainfall beginning in late August, however, led the S.C. Drought Response Committee to downgrade the drought status statewide and remove the drought declaration for Beaufort, Charleston, and Colleton counties on November 21, 2002.

The effects of El Niño were first experienced as early as March of 1997, in the form of decreased rainfall. Rainfall amounts were below normal until mid-summer when the warm phase El Niño effects were observed in the form of above normal rainfall. The full influence of El Niño with regard to rainfall was observed in the fall, when amounts were recorded in excess of the 30-year average. This “warm and wet” trend continued through April 1998. The 102-year (1895-1996) El Niño average rainfall for November to March for this region of S.C. is approximately 125% of the normal rainfall amount.

**Winds** - The prevailing wind direction between February and September ranges between South and South Southwest (180 to 200 degrees) and between October and January is North Northeast (20 degrees). The annual mean wind speed is 8.5 MPH, with August having the lowest (7.3 MPH) and March the highest (10.0 MPH) mean wind speed.

**River discharges** - There are no freshwater rivers that discharge directly into Area 20. The area is part of the Savannah River estuary, whose salinity structure is primarily determined by controlled releases of freshwater from impoundments on Savannah River and its tributaries. The New River receives freshwater input from the Great Swamp. The Wright River receives most of its freshwater input from Savannah River via Fields Cut (AIWW). Highest river discharge usually occurs in late winter and early spring due to heavy precipitation in the Blue Ridge and Piedmont areas; lowest discharge occurs during late summer and fall.

## **WATER QUALITY STUDIES**

### **DESCRIPTION OF THE PROGRAM**

The Department currently utilizes a systematic random sampling (SRS) strategy within Area 20 in lieu of sampling under adverse pollution conditions. In order to comply with NSSP guidelines, a minimum of thirty samples are required to be collected and analyzed from each station during the review period. Sampling dates are computer generated prior to the beginning of each quarterly period thereby insuring random selection with respect to tidal stage and weather. Day of week selection criteria is limited to Mondays, Tuesdays, and Wednesdays due to shipping requirements and laboratory manpower constraints. Sample schedules are rarely altered.

During July 1998, an updated data analysis procedure was formalized. Samples utilized for classification purposes are limited to those samples collected in accordance with the SRS for a 36-month period beginning January 1 and ending December 31. This allows for a maximum of 36 samples per station yet provides a six-sample “cushion” (above the NSSP required 30 minimum) for broken samples, lab error, breakdowns, etc. This also allows each annual report to meet the NSSP Triennial Review sampling criteria.

Eight hundred fifty-one (851) surface water quality samples (<1.0 ft. deep) were collected for bacteriological analyses at 25 active water quality sampling stations in Area 20 during the period 01/01/00 through 12/31/02. The lab received no samples for Station 24 on 01/05/2000 and 06/21/2000. Station 14A was deactivated in November 2000 and replaced by Station 26, which has 25 samples for the review period. Previously produced maps indicate Station 21 at an incorrect location, however; all

samples have been collected at the proper location defined as Fish Haul Creek at Port Royal Sound. Due to database constraints, Station 21 cannot simply be adjusted and indicated at the correct map location. Therefore, Station 21 has been deactivated and a new station, 27, was created at this location. Because all data has been collected from the defined location, sample results from stations 21 and 27 will be combined until Station 27 has a minimum of 30 samples.

The samples were collected in 120 ml amber glass bottles, immediately placed on ice and transported by bus to the South Carolina Department of Health and Environmental Control's Trident District Environmental Quality Control laboratory at North Charleston, South Carolina. An additional 120 ml water sample was included with each shipment as a temperature control. Upon receipt at the laboratory, sample sets that exceeded a 30-hour holding time or contained a temperature control > 10 degrees C. were discarded. Samples collected after September 1, 1986 have been analyzed using the five tube/three dilution modified A-1 method described by Nuefeld (1985).

Surface water temperatures were measured utilizing hand-held, laboratory-quality calibrated centigrade thermometers. Salinity measurements were measured in the laboratory using automatic temperature compensated refractometers. Additional field data include ambient air temperature, wind direction, tidal stage and date and time of sampling. Tidal stages were determined Nautical Software's Tides and Currents, Version 2 (1996).

The report, *A Baseline Assessment of Environmental and Biological Conditions in Broad Creek and the Okatie River, Beaufort County, South Carolina* was published in the spring of 2000. The study, conducted by SCDHEC, SCDNR, and the NOAA National Ocean Service, involved a comprehensive assessment of overall water quality, sediment quality, and biological conditions of the two study areas. The report states that system wide, fecal coliform bacteria concentrations were higher in Broad Creek than in the Okatie River. Biotyping of the fecal coliform samples that had *E. coli* indicated that Broad Creek had both a higher incidence of *E. coli* in the in the samples and a higher percentage of antibiotic resistant strains that were indicative of human sources than the Okatie River. There was also a clear association of areas with high *E.coli* counts related to human sources and obvious pollution sources (land application of treated wastewater and septic tanks) in Broad Creek. However, the majority of stations in both Broad Creek (53.3%) and the Okatie River (80%) were negative for the antibiotic resistance tests used for typing probable sources. This suggests that animal wastes are a major contributor of the fecal coliform levels observed in both systems. (SCDHEC, 2000)

In 1999, Beaufort County was investigating the use of a Special Area Management Plan (SAMP) program to address water quality concerns throughout the county. The Town of Hilton Head Island received a grant for research on Broad Creek and became part of the Beaufort County SAMP. The Town developed a Broad Creek Management Plan, which was published in January 2002.

A water quality monitoring program was initiated in 1999, consisting of bi-weekly sampling at six designated stormwater discharge sites on Broad Creek. The following water quality parameters were sampled: temperature, pH, dissolved oxygen, turbidity, nitrate, fecal coliform bacteria, salinity, ammonia, total nitrogen, and total phosphorus. In addition, tide stage was recorded for each sampling event. All water quality sampling results discussed in the management plan were collected between September 30, 1999 and April 24, 2001. A total of 41 samples were collected and analyzed. None of the stormwater discharge sites on Broad Creek meet the Approved criteria for shellfish harvesting waters. Four of the six sites did meet the standards for primary and secondary contact recreation, crabbing and fishing.

## **MONITORING RESULTS**

Water quality at stations 01, 02, 03, 04A, 05, 06, 07, 09, 10, 11, 12, 13, 15A, 17B, 18, 19A, 20A, 22, 23, 24 and 25 meet the statistical criteria for Approved classification.

Water quality at stations 16 and combined 21/27 exceeded a fecal coliform MPN geometric mean value of 14 or a fecal coliform MPN estimated 90th percentile value of 43, thus meeting the statistical criteria for a Restricted classification.

## **CONCLUSIONS**

Based on review of fecal coliform bacteriological data and the pollution source survey, Area 20 is impacted by three sources of actual or potential pollution.

### **NONPOINT SOURCE RUNOFF**

Stormwater runoff appears to be the major source of fecal coliform bacteria contamination in Area 20. Stormwater runoff from roads or parking lots discharges directly into the creeks or marsh or enters stormwater lagoons that are usually inter-connected and eventually discharge to a creek. Possible sources of fecal coliform bacteria contamination include pets, wildlife, domestic animals such as horses and cows, failing septic systems, and drainage from roads and freshwater wetlands.

### **INDIVIDUAL SEWAGE TREATMENT AND DISPOSAL SYSTEMS**

The SCDHEC Environmental Health GIS mapping study identified homes with malfunctioning or questionable Individual Sewage Treatment and Disposal Systems (ISTDS) which may impact waters of Area 20.

The report, *A Baseline Assessment of Environmental and Biological Conditions in Broad Creek and the Okatie River, Beaufort County, South Carolina* states that there was a clear association of areas with high *E.coli* counts related to human sources and obvious pollution sources (land application of treated wastewater and septic tanks) in Broad Creek.

### **BOATING IMPACTS**

A large number of vessels utilizing the Atlantic Intracoastal Waterway (AIWW) pass through Area 20, and the occupants of some these vessels may spend periods of time aboard their vessels at one of the marinas or anchored in the creeks. Ample sewage pumpout facilities exist and marina operators are conscientious but there is still a potential for discharge of untreated or partially treated sewage. The designation of Broad Creek as a No Discharge Zone along with increased public awareness should help. Boat wakes also may cause re-suspension of fecal coliform bacteria in sediments.

## **RECOMMENDATIONS**



Sampling at Station 15, Broad Creek at Lawton Creek, was discontinued in November 2002 as the station was located within the administratively Prohibited closure zone for the South Island PSD wastewater treatment plant discharge. Two new stations, 28 and 29, were created in Broad Creek at the Northern and Southern boundaries, respectively, of the closure zone.

Water quality at stations 03, 15A, 04A, 17B, 18, 24 and 25 in Broad Creek currently meets the statistical criteria for Approved classification. However, due to potential water quality variability along with the knowledge that stormwater runoff can have an adverse impact on water quality and public health, the harvest classification of these stations is recommended to retain a Conditionally Approved classification. As in the previous survey, the Conditionally Approved area is recommended to extend upstream from Station 03 to Station 25, excluding all administratively Prohibited closure zones.

For the calendar year 2002, 8 samples were collected at each station in the Broad Creek Conditional Area while in the Open status. Analysis of that data indicates all stations in the Conditional Management Area with the exception of stations 24 and 25 meet the statistical criteria for an Approved classification. Analysis of sample data for the 3-year review period was conducted (see Conditionally Approved Areas Rainfall Correlation). Excluding sample results that had 24-hour rainfall amounts greater than or equal to 1.40 inches (a 0.10 inch reduction from the existing management criteria) on the day of sampling or within 14 days prior to the sample date, the analysis indicates that stations 24 and 25 will meet Approved criteria if managed on this specific criteria. Therefore, a reduction of the rainfall amount required to close the Conditionally Approved area in Broad Creek (from 1.50 to 1.40 inches in a 24-hour period as recorded at the Broad Creek PSD wastewater treatment plant) is recommended. Additionally, Station 28 and Station 29 are recommended to be included in the list of stations that are monitored for the reopening of the Broad Creek Conditionally Approved area.

Previously produced maps indicate Station 21 at an incorrect location, however; all samples have been collected at the proper location defined as Fish Haul Creek at Port Royal Sound. Due to database constraints, Station 21 cannot simply be adjusted and indicated at the correct map location. Station 21 has been deactivated and a new station, 27, was created at this location. Because all data has been collected from the defined location, sample results from stations 21 and 27 will be combined until Station 27 has a minimum of 30 samples.

Station 16 exceeded a fecal coliform MPN geometric mean value of 14 and a fecal coliform MPN estimated 90th percentile of 43, thereby meeting the statistical criteria for a Restricted classification. Analysis of the sampling data was conducted to determine if a correlation between rainfall and fecal coliform concentrations existed so that a Conditionally Approved classification could be applied. The amount of rainfall was too low to practically manage the area as Conditionally Approved. Therefore, Broad Creek, from Station 25 to the headwaters, is recommended to retain a Restricted classification.

Relaying and container relaying of shellfish from Restricted areas to Approved areas, and depuration are other options available for harvest of shellfish within Restricted areas in Area 20.

The shoreline survey and bacteriological data review of shellfish Management Area 20 indicates that no changes in classification boundary descriptions are necessary. The following growing waters classification of Area 20 is recommended (see Figure 3):

**Prohibited** (Administrative closure):

1. Those waters adjacent to Harbor Town marina and 1000 feet northeast and southeast; 1000 feet adjacent to Moss Creek marina; 1000 feet adjacent to Skull Creek Marina; 1000 feet adjacent to Outdoor Resorts marina; 1000 feet adjacent to Windmill Harbor marina, 1000 feet adjacent to South Beach marina including area within line from offshore edge of South Beach Marina closure zone to the offshore edge of Harbor Town marina closure zone;
2. Those waters adjacent to Palmetto Bay marina 100 feet north to the unnamed creek adjacent to Spanish Wells Plantation, extending west to the oyster bank and southward to include the docking area of Haig Point embarkation;
3. Those waters around Shelter Cove marina 1000 feet northeast and southeast from the mouth of the harbor to the oyster bank on the opposite side;
4. Those waters around Wexford Harbor from the unnamed island that extends northeast along Broad Creek to the shoreline northwest of Wexford on the opposite side;
5. Those waters adjacent to Broad Creek marina to 1000 feet south, extending eastward across Broad Creek to the oyster bank and 1000 feet north adjacent to the private docks;
6. Those waters adjacent to the boat docking facilities at Villages on Skull Creek, Hilton Head Plantation, Long Cove, Baynard Cove, Gull Point community, and Schillings Boat House;
7. Those waters in Broad Creek adjacent to the Sea Pines outfall 1000 feet north and south of the mouth of Lawton Creek;
8. Folly Creek, the entire tributary to its confluence with the Atlantic Ocean.

**Restricted / No Depuration:** None

**Restricted:**

1. Broad Creek, from the boundary of the Conditionally Approved area at Station 25, to the headwaters, including Station 16;
2. Fish Haul Creek, from its headwaters to its confluence with Port Royal Sound.

**Conditionally Approved:**

Broad Creek, from Station 03 to Station 25 (excluding all Administratively Prohibited closure zones). The Conditionally Approved area will consist only of the main channel of Broad Creek between stations 04A and 17B, excluding the closure zones. Between stations 17B and 25, the Conditionally Approved area will consist of Broad Creek proper and the adjacent marshes, excluding all closure zones.

**Approved:** The remaining waters of Area 20.

**Station Addition/Deactivation/Modification:** None

Analysis of sampling data for Area 20 demonstrates the probability of a significant impact from rainfall exceeding 4.00" in a 24 hour period. Therefore, a precautionary closure of Area 20 will be implemented following rainfall events of greater than 4.00" in a 24 hour period, as measured at Broad Creek PSD WWTP. This methodology is associated with the concept of the Probable Maximum Precipitation (PMP). PMP estimates for the coastal United States has been published in a series of hydro-meteorological reports (HMRs) by the National Weather Service (*National Weather Service*). PMP estimates for South Carolina's growing areas are derived from HMRs 51, 52, and 53 (*National*

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**TABLE #1**  
**Shellfish Management Area 20**  
**WATER QUALITY SAMPLING STATIONS DESCRIPTION**

<b><u>Station</u></b>	<b><u>Description</u></b>
01	Braddock Point- South end of Hilton Head Island
02	Calibogue Sound, Marker 32
03	Shark Bank and Broad Crk- CSZ Sea Pines WWTP, Marker 2
04A	Broad Creek at Palmetto Bay Marina CSZ
05	May River at Calibogue Sound
06	Jarvis Creek at Calibogue Sound
07	Buckingham Landing at bridge
09	Mackey Creek and Chechessee River
10	Skull Creek at small creek from Mariner's Cove
11	Skull Creek, Marker 19
12	Skull Creek behind Hilton Head Seafood Company
13	Skull Creek and Port Royal Sound
15A	Broad Creek at Calibogue Sound- North end of Buck Island
16	Creek behind Lynn Smith's Oyster Plant at Broad Creek
17B	Broad Creek at Broad Creek Marina CZ
18	Shelter Cove Marina
19A	Broad Creek at Harbour Town Marina CZ
20A	Moss Creek Marina CZ
22	Old House Creek at Calibogue Sound
23	Jarvis Creek at first major "T"
24	Broad Creek at 1st major creek upstream of station 18
25	Broad Creek at confluence of channel leading to Old Oyster Factory
26	Northwest of South Beach Marina closure zone
27	Fish Haul Creek at Port Royal Sound <b>(new)</b>
28	Broad Creek at Southern boundary of South Island WWTP Prohibited closure zone <b>(new)</b>
29	Broad Creek at Northern boundary of South Island WWTP Prohibited closure zone <b>(new)</b>
(Total Active 26)	

Figure 1.  
Shellfish Management  
Area 20  
Prior Classification

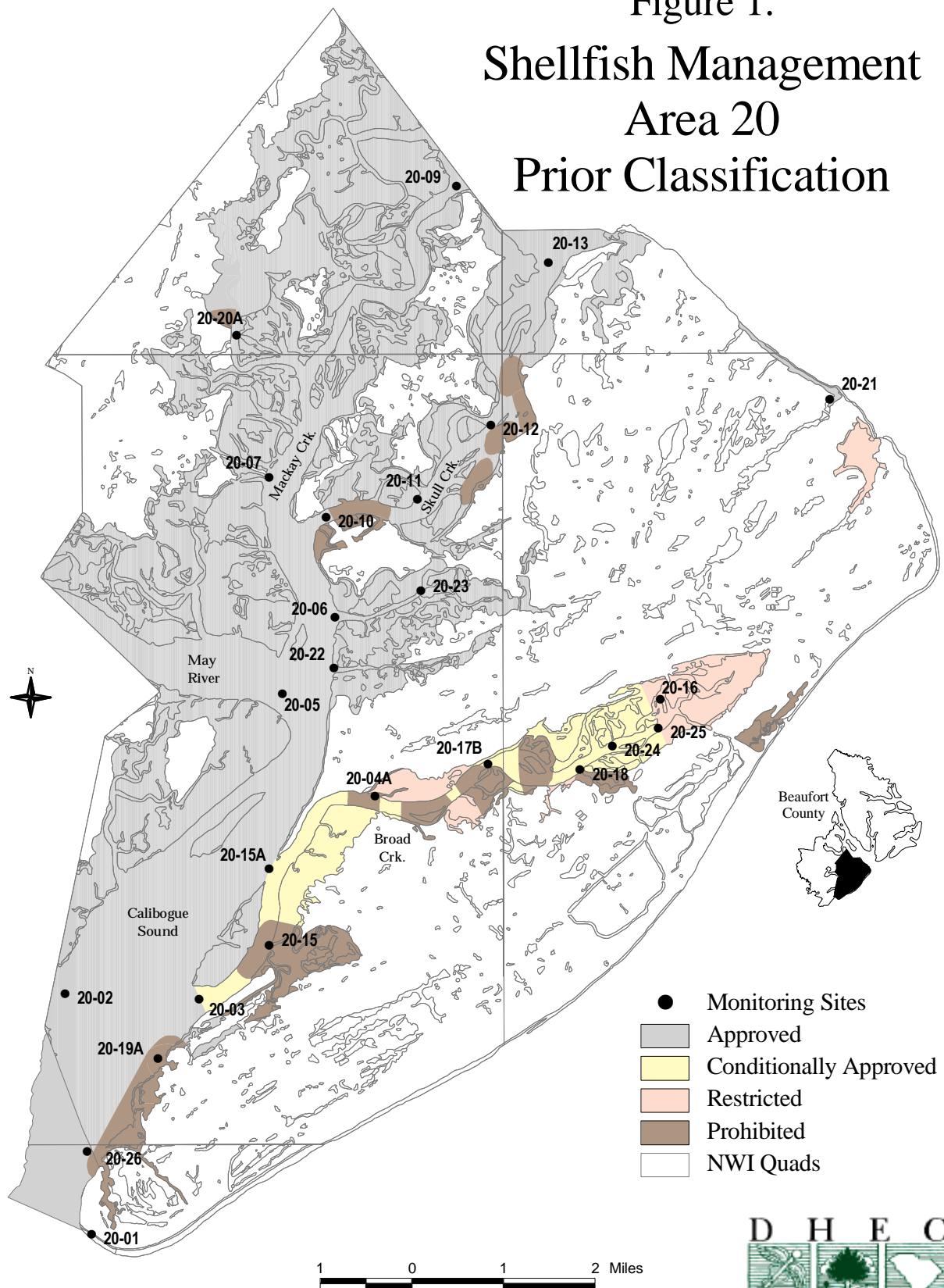


Figure 2.  
Shellfish Management  
Area 20  
Current Classification

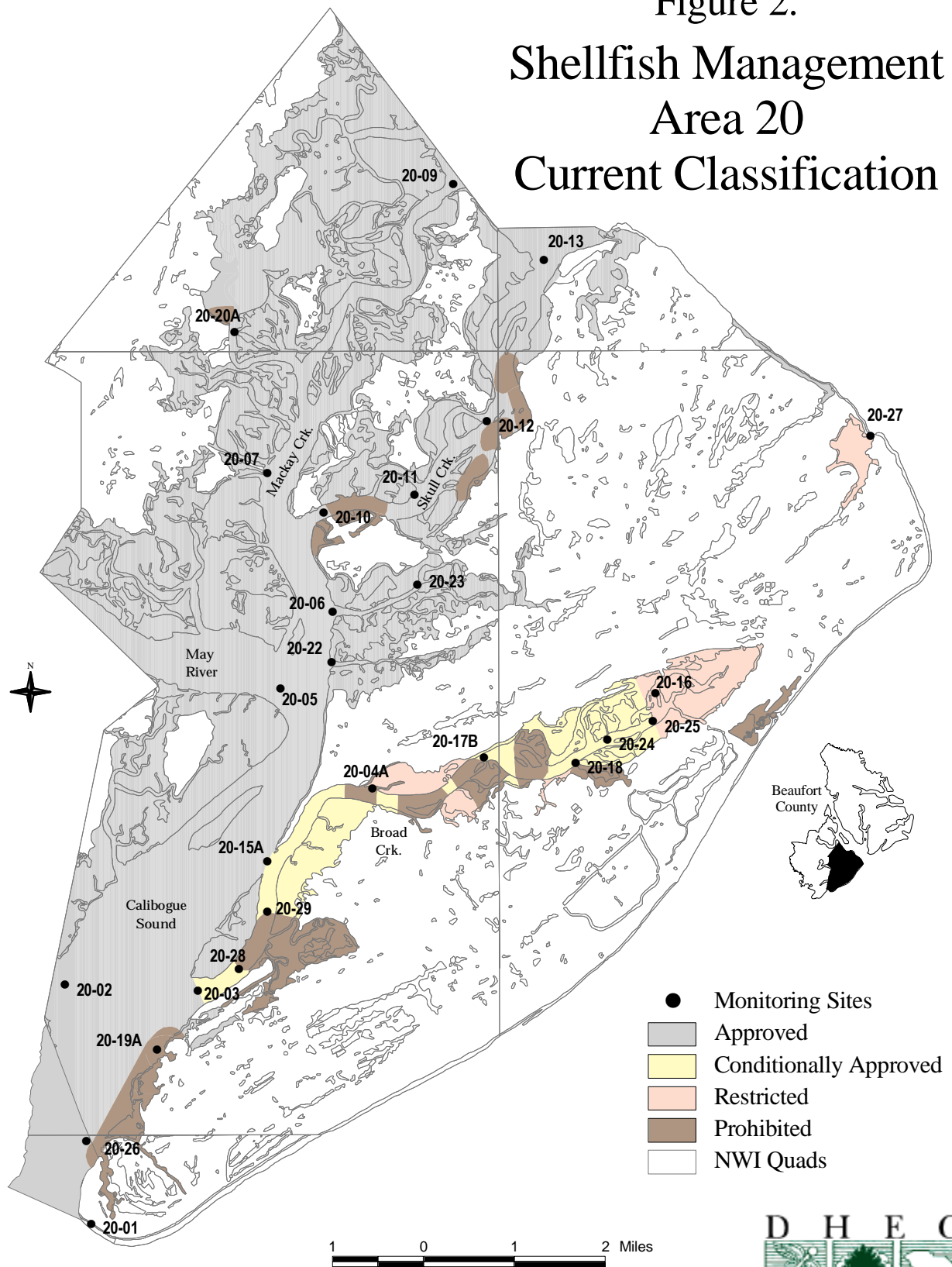
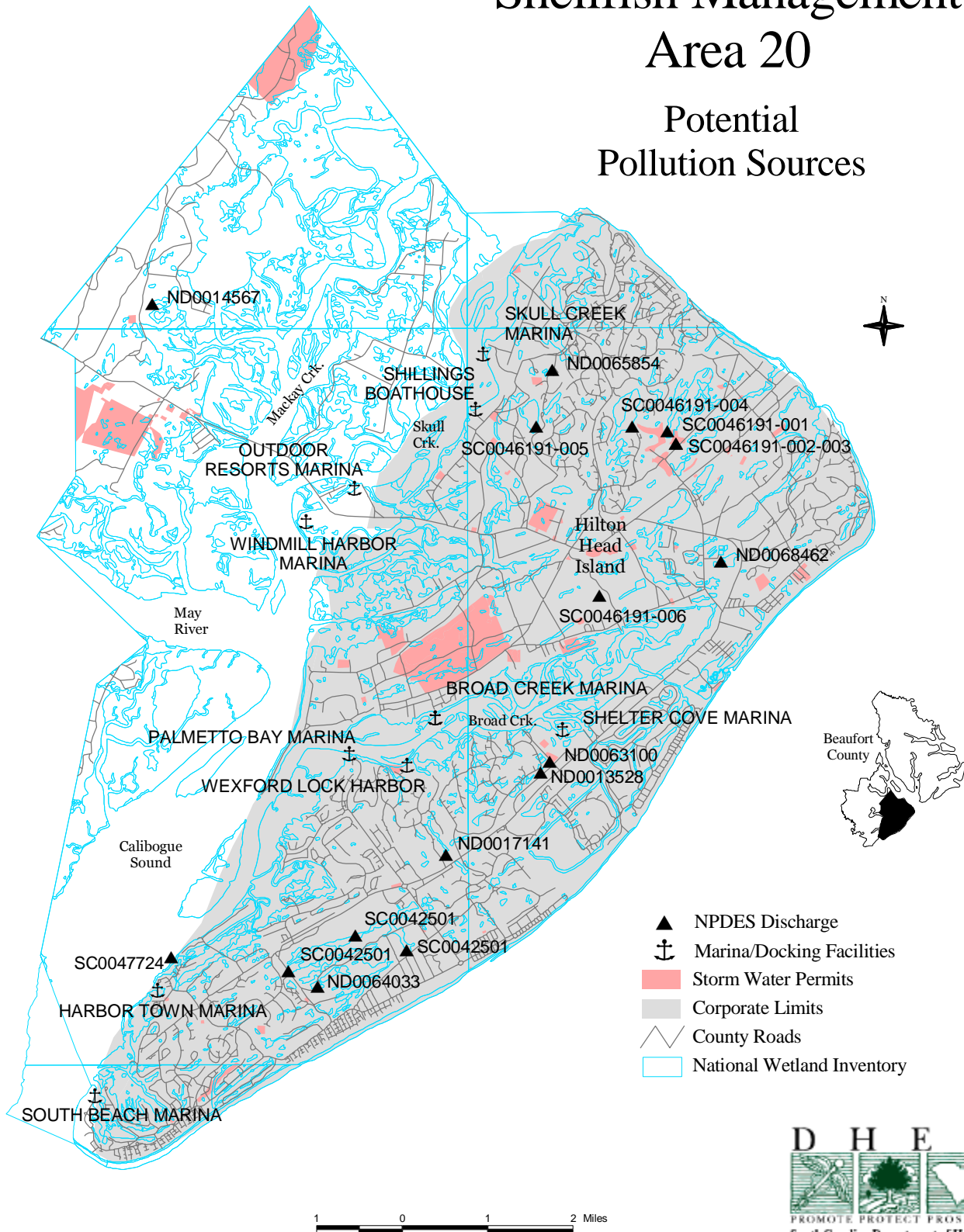


Figure 3.  
Shellfish Management  
Area 20  
Potential  
Pollution Sources





**TABLE #2**  
**Shellfish Management Area 20**  
**FECAL COLIFORM BACTERIOLOGICAL DATA SUMMARY**  
*from Shellfish Water Quality Sampling Stations between*

**January 1, 2000 and December 31, 2002**

Station #?	1	2	3	4A	5	6	7	9	10	11	12
Samples	36	36	36	36	36	36	36	36	35	36	36
GeoMean	2.6	2.3	2.6	6.8	2.5	3.1	2.9	2.5	3.0	3.0	2.7
90th%ile	5	3	6	24	5	8	5	4	7	6	5
Water Quality	A	A	A	A	A	A	A	A	A	A	A
Classification	A	A	CA	CA	A	A	A	A	P	A	A

Station #?	13	15A	16	17B	18	19A	20A	21/2 '	22	23	24
Samples	36	36	36	36	36	36	36	36	36	36	34
GeoMean	2.8	5.9	11.1	5.3	5.3	2.3	3.6	12.4	3.1	4.2	6.3
90th%ile	6	21	72	15	18	4	9	126	8	13	24
Water Quality	A	A	R	A	A	A	A	R	A	A	A
Classification	A	CA	R	CA	CA	A	A	R	A	A	CA

Station #?	25	26									
Samples	36	25									
GeoMean	5.4	2.6									
90th%ile	19	6									
Water Quality	A	New									
CLASSIFICATION	R	New									

A - Approved      CA - Conditionally Approved      R - Restricted  
RND - Restricted/No Depuration      P - Prohibited

**TABLE #2 (B)**  
**Shellfish Management Area 20**

***FECAL COLIFORM BACTERIOLOGICAL DATA SUMMARY***

**from Conditional Management Area Stations**

**collected while in Open Status between**

**January 1, 2002 and December 31, 2002**

Station # ?	03	04A	15A	17B	18	24	25				
SAMPLES	8	8	8	8	8	8	8				
GEOMEAN	3.4	5.7	8.1	6.4	7.4	11.4	9.6				
90TH %ILE	17	21	25	19	31	47	58				
WATER QLTY	A	A	A	A	A	R	R				
CLASSIFICATION	CA	CA	CA	CA	CA	CA	CA				

Station # ?											
SAMPLES											
GEOMEAN											
90TH %ILE											
WATER QLTY											
CLASSIFICATION											

Station# ?											
SAMPLES											
GEOMEAN											
90TH %ILE											
WATER QLTY											
CLASSIFICATION											

**A** - Approved      **CA** - Conditionally Approved      **R** - Restricted  
**RND** - Restrict ed/No Depuration      **P** - Prohibited

**TABLE #3**

## **Water Quality Sampling Stations Data**

**Shellfish Management Area 20**

## **BACTERIOLOGICAL DATA**

Data for each shellfish station listed in this report's "Fecal Coliform Bacteriological Data Summary Table" and in other shellfish reports, can be obtained through South Carolina's Department of Health and Environmental Control - Freedom of Information office at the address below.

Freedom of Information  
2600 Bull Street  
Columbia, SC 29201

Any explanation or clarity needed on the report's content can be obtained by contacting the preparer(s), and/or reviewer(s) listed on the cover page.

**TABLE #4**

## **Rainfall Data**

### **Shellfish Management Area 20**

**SOURCE :** NOAA/National Weather Service  
National Climatic Data Center, Asheville, North Carolina 28801

Broad Creek Public Service District WWTP

**Shellfish Management Area 20**  
**A SUMMARY OF RAINFALL**  
**DURING AND PRIOR TO FECAL COLIFORM SAMPLING**

<b>Sample Date</b>	<b>Sample Date + 24 hours</b>	<b>Sample Date</b>	<b>Sample Date - 24 hours</b>	<b>Sample Date - 48 hours</b>	<b>Sample Date - 72 hours</b>
01/05/00	0.00"	0.01"	0.19"	0.00"	0.00"
02/08/00	0.00"	0.00"	0.00"	0.00"	0.00"
03/06/00	0.00"	0.00"	0.00"	0.79"	0.00"
04/04/00	0.00"	0.00"	0.00"	0.00"	0.00"
05/09/00	0.00"	0.00"	0.00"	0.00"	0.00"
06/21/00	0.02"	0.03"	0.09"	0.00"	0.00"
07/05/00	0.00"	0.00"	0.00"	0.00"	0.00"
08/15/00	0.00"	0.00"	0.00"	0.00"	1.39"
09/06/00	0.06"	0.23"	1.52"	1.16"	1.16"
10/11/00	0.00"	0.00"	0.00"	0.00"	0.00"
11/27/00	0.00"	0.00"	0.00"	0.67"	0.03"
12/05/00	0.00"	0.00"	0.00"	0.10"	0.00"
01/10/01	0.03"	0.00"	0.00"	0.00"	0.20"
02/14/01	0.00"	0.00"	0.00"	0.37"	0.01"
03/28/01	0.52"	0.13"	0.00"	0.00"	0.23"
04/04/01	0.00"	0.00"	0.03"	0.00"	0.00"
05/29/01	0.00"	0.15"	0.03"	0.01"	0.00"
06/11/01	0.14"	0.08"	0.08"	0.46"	0.25"
07/24/01	0.00"	0.23"	1.07"	0.00"	1.30"
08/21/01	0.00"	0.00"	0.70"	0.80"	1.63"
09/10/01	0.00"	0.24"	0.14"	0.01"	0.00"
10/01/01	0.00"	0.00"	0.00"	0.00"	0.00"
11/05/01	0.00"	0.00"	0.01"	0.00"	0.00"
12/18/01	0.01"	0.24"	0.01"	0.00"	0.01"
01/08/02	0.00"	0.00"	0.00"	0.34"	0.00"
02/05/02	0.22"	0.00"	0.00"	0.00"	0.00"
03/13/02	0.00"	0.03"	0.36"	0.00"	0.00"
04/17/02	0.00"	0.00"	0.00"	0.00"	0.00"
05/01/02	0.00"	0.00"	0.00"	0.00"	0.00"
06/12/02	0.00"	0.00"	0.00"	0.00"	0.00"
07/30/02	0.00"	0.00"	0.00"	0.00"	0.01"
08/20/02	0.00"	0.00"	0.00"	1.37"	0.00"
09/18/02	3.27"	0.08"	0.00"	0.00"	0.21"
10/08/02	0.04"	1.20"	0.15"	0.00"	0.00"
11/19/02	0.00"	0.01"	0.00"	0.13"	1.40"
12/17/02	0.00"	0.00"	0.00"	0.00"	0.00"

[ Amounts Shown Are per Day, not Cumulative ] Rainfall data supplied by Broad Creek PSD

# ANNUAL TABLE OF DAILY RAINFALL DATA

*SOURCE: NOAA National Weather Services National Climatic Data Center  
Ashville, NC 28801 (Broad Creek Public Service District WWTP)*

2000	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00
3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.07
4th	0.00	0.00	1.45	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	0.00
5th	0.16	0.00	0.12	0.00	0.00	0.47	0.00	0.53	0.37	0.05	0.16	0.00
6th	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	3.52	0.01	0.00	0.00
7th	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.01	0.00
8th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
9th	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10th	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93
11th	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
12th	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.17	0.00	0.00	0.00	0.01
13th	0.00	0.60	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.00
14th	0.00	0.87	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
15th	0.00	0.00	0.00	1.03	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.02
16th	0.00	0.00	1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
17th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.03
18th	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00
19th	0.10	0.03	1.51	0.00	0.00	0.33	0.00	0.41	0.18	0.00	0.39	0.00
20th	0.17	0.00	0.16	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.70	0.09
21st	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.23	0.00	0.00	0.00
22nd	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
23rd	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00
24th	0.29	0.00	0.00	0.00	0.00	0.05	0.30	0.00	0.00	0.00	0.00	0.00
25th	0.72	0.00	0.00	0.61	0.00	0.00	1.37	0.00	0.00	0.00	0.67	0.00
26th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00
27th	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28th	0.00	0.21	0.15	0.23	0.00	0.45	0.13	0.00	0.00	0.00	0.00	0.06
29th	0.74	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	1.44
30th	0.41		0.00	0.46	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00
31st	0.34		0.38		0.00		0.63	0.00		0.00		0.00

(Monthly Figures)

Year's Rainfall Total: 34.85

SUM	3.40	1.71	4.90	2.71	0.38	2.45	3.49	2.86	7.85	0.06	2.31	2.73
MAX	0.74	0.87	1.51	1.03	0.38	0.47	1.37	1.72	3.52	0.05	0.70	1.44
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVG	0.11	0.06	0.16	0.09	0.01	0.08	0.11	0.09	0.26	0.00	0.08	0.09

Note:"--" denotes missing data  
(Shellfish Management Area 20)

# ANNUAL TABLE OF DAILY RAINFALL DATA

*SOURCE: NOAA National Weather Services National Climatic Data Center  
Ashville, NC 28801 (Broad Creek Public Service District WWTP)*

2001	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	0.00	0.01	0.00	0.00	0.00	0.00	0.20	0.00	0.05	0.00	0.01	0.00
2nd	0.00	0.01	0.07	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
3rd	0.00	0.25	0.16	0.03	0.00	0.61	0.65	0.00	1.14	0.00	0.00	0.00
4th	0.00	0.00	0.32	0.00	0.00	0.00	0.18	0.00	2.13	0.00	0.01	0.00
5th	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.46	1.11	0.00	0.00	0.00
6th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01
7th	0.20	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.01	0.19
8th	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.01	0.00	0.00	0.00
9th	0.00	0.00	0.01	0.00	0.00	0.46	0.00	0.00	0.14	0.00	0.00	0.00
10th	0.00	0.12	0.00	0.00	0.00	0.08	0.00	0.04	0.24	0.05	0.00	0.69
11th	0.03	0.01	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.35
12th	0.03	0.37	0.70	0.00	1.68	0.14	0.04	0.00	0.21	0.00	0.00	0.00
13th	0.00	0.00	0.04	0.02	0.00	0.33	0.17	0.45	0.05	0.00	0.00	0.00
14th	0.00	0.00	0.20	0.00	0.00	0.05	0.00	0.30	0.30	0.00	0.00	0.00
15th	0.00	0.00	0.51	1.02	0.00	0.02	0.00	0.04	0.06	0.19	0.01	0.01
16th	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17th	0.00	0.03	0.00	0.00	0.00	0.92	0.00	0.00	0.00	0.00	0.00	0.01
18th	0.02	0.00	0.01	0.00	0.00	0.01	0.00	1.63	0.00	0.00	0.01	0.24
19th	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.01
20th	0.27	0.00	1.12	0.00	0.00	0.01	2.19	0.70	0.00	0.01	0.00	0.00
21st	0.00	0.00	0.01	0.00	0.00	0.31	1.30	0.00	0.00	0.00	0.00	0.00
22nd	0.33	0.11	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00
23rd	0.71	0.00	0.00	0.00	0.09	0.00	1.07	0.00	0.27	0.01	0.02	0.00
24th	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.12	0.71	0.00	0.01	0.00
25th	0.00	0.21	0.23	0.66	0.00	0.86	0.00	0.00	0.03	0.00	0.00	0.00
26th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27th	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28th	0.00	0.00	0.13	0.00	0.03	0.05	0.18	0.00	0.00	0.00	0.01	0.00
29th	0.00		0.52	0.00	0.15	0.00	0.03	0.00	0.00	0.00	0.00	0.00
30th	0.09		0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00
31st	0.00		0.00		0.00		0.00	0.00		0.00		0.00

(Monthly Figures)

Year's Rainfall Total: 34.63

SUM	1.68	1.12	4.49	1.74	1.96	4.35	6.43	4.54	6.46	0.26	0.09	1.51
MAX	0.71	0.37	1.12	1.02	1.68	0.92	2.19	1.63	2.13	0.19	0.02	0.69
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVG	0.05	0.04	0.14	0.06	0.06	0.15	0.21	0.15	0.22	0.01	0.00	0.05

Note:"--" denotes missing data  
(Shellfish Management Area 20)



# ANNUAL TABLE OF DAILY RAINFALL DATA

*SOURCE: NOAA National Weather Services National Climatic Data Center  
Ashville, NC 28801 (Broad Creek Public Service District WWTP)*

2002	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	0.00	0.01	0.00	0.32	0.00	0.00	0.00	0.00	0.44	0.27	0.01	0.00
2nd	0.80	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00
3rd	0.02	0.00	1.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00
5th	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.04	0.66
6th	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.45	0.00
7th	0.00	1.03	0.01	0.00	0.00	0.00	0.62	0.00	0.00	0.15	0.00	0.00
8th	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	1.20	0.01	0.01
9th	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01	0.19
10th	0.00	0.17	0.00	0.23	0.00	0.00	0.00	0.00	0.00	1.10	0.08	0.61
11th	0.00	0.01	0.00	0.04	0.00	0.00	0.16	0.00	0.00	0.37	0.07	0.08
12th	0.80	0.00	0.36	0.00	0.00	0.00	0.87	0.00	0.00	0.00	1.25	0.05
13th	0.27	0.00	0.03	0.00	0.14	0.00	0.07	0.37	1.93	0.02	0.46	0.52
14th	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.00	0.00
15th	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.21	0.51	0.00	0.00
16th	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40	0.00
17th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00
18th	0.00	0.00	0.00	0.00	0.96	0.34	0.00	1.37	0.08	0.00	0.00	0.00
19th	0.02	0.00	0.00	0.00	0.87	0.06	0.00	0.00	3.27	0.00	0.01	0.02
20th	0.00	0.08	0.00	0.00	0.00	1.46	0.13	0.00	0.01	0.00	0.00	0.07
21st	0.05	0.02	0.23	0.00	0.00	1.56	0.01	0.00	0.01	0.00	0.08	0.00
22nd	0.00	0.01	0.00	0.00	0.00	4.16	0.00	0.29	0.00	0.00	0.00	0.00
23rd	0.00	0.10	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00
24th	0.00	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.51	0.02	0.01	1.19
25th	0.09	0.00	0.00	0.08	0.00	0.58	0.00	0.72	1.05	0.01	0.00	0.02
26th	0.00	0.02	0.19	0.00	0.00	0.11	0.34	2.44	0.40	0.00	0.01	0.00
27th	0.00	0.00	0.15	0.00	0.00	0.01	0.01	2.03	0.66	0.01	0.01	0.00
28th	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.94	0.00	1.28	0.00	0.00
29th	0.00		0.00	0.00	0.00	0.00	0.00	1.41	0.15	0.05	0.00	0.00
30th	0.01		0.00	0.00	0.01	0.00	0.00	3.80	0.01	0.58	0.00	0.00
31st	0.01		0.17		0.00		0.00	3.44		0.00		0.22

(Monthly Figures)

Year's Rainfall Total: 62.64

SUM	2.72	1.90	3.69	0.67	1.98	9.40	2.28	17.68	8.89	5.65	4.14	3.64
MAX	0.80	1.03	1.33	0.32	0.96	4.16	0.87	3.80	3.27	1.28	1.40	1.19
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVG	0.09	0.07	0.12	0.02	0.06	0.31	0.07	0.57	0.30	0.18	0.14	0.12

Note:"--" denotes missing data  
(Shellfish Management Area 20)

# **Conditional Areas Management Plan**

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## **Shellfish Management Area 20**

**Shellfish Management Area 20**  
**BROAD CREEK**  
**CONDITIONAL AREA MANAGEMENT PLAN**  
**JULY, 2003**

**I. AREA DESCRIPTION**

The Broad Creek area was first classified as Conditionally Approved in the 1998 Annual Update. In January, 2001, a portion of the Conditionally Approved area (between stations 17B and 24) was leased by SCDNR to Richard Mitchell as Culture Permit C-031. The remainder of the Conditionally Approved area is open to the public for recreational harvesting.

Stations 03 and 15A were added to the Broad Creek Conditionally Approved area in the 2001 Annual Update. This action extended the boundary to the mouth of Broad Creek at Calibogue Sound. Station 25 was classified for the first time in the 2002 Annual Update, and the area between stations 24 and 25 was added to the Broad Creek Conditionally Approved area.

The Town of Hilton Head installed a kiosk at the Marshland Road boat landing on Broad Creek in 2003. A harvest classification map of the Broad Creek area, an Open/Closed sign for the Conditionally Approved area, and other shellfish harvesting information is included.

Stations 03, 15A, 04A, 17B, 18, 24, 25, 28, and 29 are located within the Broad Creek Conditionally Approved area. All stations meet the criteria for Approved classification in the 2003 Annual Update. For the calendar year 2002, eight samples were collected at each station in the Broad Creek Conditional Area while in the open status. Analysis of that data indicates all stations in the Conditional Management Area except 24 and 25 meet the statistical criteria for Approved classification. Analysis of sample data for the survey review period (2000 through 2002) was conducted (see attached data analyses excluding data collected following rainfall  $\geq 1.40$ "/24 hours). Excluding sample results which had 24-hour rainfall amounts greater than or equal to 1.40 inches on the day of sampling or within 14 days prior to the sample date, the analysis indicates that stations 24 and 25 will meet Approved criteria if managed according to the plan. Therefore, the rainfall amount required to close the Conditionally Approved area in Broad Creek will be reduced from 1.50 to 1.40 inches in a 24-hour period.

Station 15, confluence of Broad Creek and Lawton Creek, has been de-activated. The station was located within the Prohibited closure zone for the South Island WWTP discharge from the Forest Preserve wetland. In order to more accurately assess the Conditionally Approved area adjacent to the South Island WWTP closure zone, two stations were created in Broad Creek. Station 28 is located in Conditionally Approved waters adjacent to the Northern boundary of the Prohibited closure zone and station 29 is located at the Southern boundary. Water quality at these two stations will be utilized in management of the Broad Creek Conditional Management area.

Historically, the classification of stations 15A, 04A, and 17B have alternated between Restricted and Approved. Special sampling studies and analysis of routine shellfish sampling data indicates that water quality in the Broad Creek Conditionally Approved area is impacted by rainfall and stormwater discharges. To protect public health, the classification for all of the stations will remain as Conditionally Approved. There are no mariculture operations in the area, therefore year round harvesting does not occur.

The following is a description of the Area 20 Conditionally Approved area as indicated in the 2003 Annual Update:

*Broad Creek, from station 03 to station 25 (excluding all administratively Prohibited closure zones). The Conditionally Approved area will consist only of the main channel of Broad Creek between stations 04A and 17B, excluding the closure zones. Between stations 17B and 25, the Conditionally Approved area will consist of Broad Creek proper and adjacent marshes, excluding all closure zones.*

A map indicating the Area 20 Conditionally Approved area boundary is included in the 2003 Annual Reports.

## **II. FACTORS INDICATING SUITABILITY OF BROAD CREEK AS A CONDITIONALLY APPROVED AREA**

- A. Stations 03, 04A, 15B, 17B, 18, 24, and 25 currently meet the statistical criteria for an Approved classification. For the calendar year 2002, eight samples were collected at each station in the Broad Creek Conditional Area while in the Open status. Analysis of that data indicates all stations in the Conditional Management Area except 24 and 25 meet the statistical criteria for Approved classification. Analysis of sample data for the survey review period (2000 through 2002) was conducted (see attached data analysis excluding data collected following rainfall  $\geq 1.40''/24$  hours). Excluding sample results having 24-hour rainfall amounts greater than or equal to 1.40 inches on the day of sampling or within 14 days prior to the sample date, the analysis indicates that stations 24 and 25 will meet Approved criteria if managed according to the plan. Therefore, the rainfall amount required to close the Conditionally Approved area in Broad Creek will be reduced from 1.50 to 1.40 inches in a 24-hour period.
- B. The major pollution source adversely affecting water quality in Broad Creek is nonpoint source in origin.
- C. Broad Creek receives no substantial freshwater input other than from rainfall and associated runoff.
- D. Broad Creek has a tidal range sufficient to allow sufficient exchange with coastal ocean waters. This exchange results in a typical salinity range of 24 ppt to 30 ppt. Depressed salinities due to rainfall are temporary.

- E. Broad Creek is relatively small geographically and does not present major patrol difficulties. It is also a leased area and therefore not open to the public for harvesting.

### III. PREDICTABLE POLLUTION EVENTS THAT CAUSE CLOSURE

#### Meteorological Events

1. The Broad Creek Conditionally Approved area will be closed upon receipt of 1.40 inches or more of rainfall in a 24 hour period as measured by the Broad Creek PSD wastewater treatment plant personnel.
2. A review of rainfall data for the past five years (1998 to 2002) indicates that the area will receive an average of 3.6 rainfall events per year during shellfish harvesting season equal to or greater than 1.40". Although some events are likely to crossover, each event is considered to be separated from the subsequent event by a minimum duration of 14 days. With this in mind, one could expect the Conditionally Approved area in Broad Creek to remain in an open status during 79% ( 190 days) of the harvest season (September 16 through May 15; a total of 241 days).

#### Number of 24- hour Rainfall events $\geq$ 1.40 inches Sept. 16 to May 15

1998	8
1999	4
2000	3
2001	1
2002	2

Total  $18 / 5 = 3.6 / \text{yr}$   $3.6 \times 14 \text{ day closure} = 50.4 \text{ days closed}$   
( $50.4 / 241 \text{ days in harvest season} = 21 \% \text{ closed, } 79\% \text{ open}$ )

3. Any significant input from migratory waterfowl populations is offset by tidal flushing.

### IV. IMPLEMENTATION OF A CONDITIONAL AREA CLOSURE

The Low Country EQC District Shellfish program manager is the responsible party for determining compliance with all aspects of this plan, including the tracking of rainfall criteria violations. In the event that the manager shall be unavailable, a responsible employee shall be designated responsibility for tracking, compliance, and notification procedures.

#### A. Implementation of Closure (September through May)

The following procedures shall be used in the event a closure is necessary:

1. The State Shellfish Program Manager (or his designee) shall be notified immediately.
2. SCDHEC's Office of Media Relations is the responsible authority for issuance of news releases. Media Relations (Media Relations) shall be notified within

two hours of the determination of the need for a closure. They shall be provided with specific information regarding the pollution event and affected area. In the event of the need for a weekend or holiday closure, Low Country District Shellfish program staff will contact Media Relations through their on-call pager number or through the Department's emergency response telephone number.

3. Within four hours of a determination of the need for a closure, the Low Country District Shellfish staff shall notify the South Carolina Department of Natural Resources (SCDNR), Office of Commercial Fisheries Management, & SCDNR Law Enforcement (Ft. Johnson), by telephone and/or fax.
4. SCDHEC Certified Shellfish Shippers with interests in the affected area shall be notified by Low Country District Shellfish program staff. SCDNR is the State agency having authority for the issuance of individual commercial shellfish harvest permits and should provide notification to individual permittees.
5. SCDHEC has posted an adequate number of conditional area signs throughout the area. Additionally, a map and a reversible Open/Closed sign indicating the current harvesting status of the Broad Creek Conditional Management area is posted at the Town of Hilton Head Island's information kiosk located at the Beaufort County boat landing on Marshland Road. The sign will be turned to Closed immediately following issuance of the news release.
6. During the closure period, a Low Country EQC District law enforcement officer shall insure patrols are conducted at a frequency sufficient to deter illegal harvest activities. Schedules shall include night and weekend patrols. Documentation of these patrols shall be maintained. Unless a Low Country EQC officer has personal knowledge that a violator has been notified of the closure, under no circumstance shall a summons be issued during the first 48 hours following the initial call to Media Relations. Written warnings should be issued during this 48 hour period and all shellfish should be returned to the water.

**B. Management of Conditional Areas Extraneous to the Normal Shellfish Harvest Season**

The Broad Creek Conditionally Approved area shall remain in the closed status from May 15 through September 15.

**C. Enforcement of Closures**

1. DHEC is the agency responsible for public health protection. This includes public notice and closures of shellfish management areas
2. The Broad Creek Conditionally Approved area will be routinely patrolled during closures of Conditionally Approved areas at frequencies sufficient to prevent illegal harvesting. DHEC patrol officers may coordinate with other law

enforcement officers to insure adequate area coverage.

**V. CONTROL ELEMENTS USED TO REOPEN AFTER A POLLUTION EVENT**

Opening of areas following closure due to violation of management plan criteria shall adhere to the control elements.

1. The area shall remain closed for a minimum period of 14 consecutive days following the end of a rainfall event. If, during the initial closure period, a subsequent event occurs that meets the criteria for a closure, the area shall remain closed for 14 consecutive days following the occurrence of the subsequent event.
2. The bacteriological water quality at all stations located within, or on the boundary of, the closed Conditionally Approved area shall be assessed prior to reopening. For the year 2003 report these stations shall be 03, 15A, 04A, 17B, 18, 24, 25, 28, and 29. The area shall remain closed and be re-sampled at a later date if greater than 15% of the samples exceed a fecal coliform MPN of 43.
3. Low Country District Shellfish staff and the State Shellfish Program Manager (or his designee) shall concur on the decision to reopen the area.
4. Low Country District Shellfish shall notify SCDNR, Division of Commercial Fisheries Management, of the opening immediately following issuance of the news release.
5. Local Certified Shellfish Shippers shall be notified by SCDHEC of the opening as soon as possible.
6. The sign at the Town of Hilton Head Island's information kiosk located at the Beaufort County boat landing on Marshland Road will be turned to Open immediately following issuance of the news release.

**VI. MANAGEMENT PLAN EVALUATION**

This plan shall be evaluated once per year and included as a part of the Shellfish Management Area 20 Annual Update.

**Shellfish Management Area 20**  
**BROAD CREEK**  
**EVALUATION OF CONDITIONAL AREA MANAGEMENT PLAN**  
**July, 2003**

**1. BACKGROUND INFORMATION**

The following is a description of the Area 20 Conditionally Approved areas as indicated in the July, 2003 Annual Update. This area was first classified as Conditionally Approved in the 1998 Annual Update.

*Broad Creek, from station 04A to station 25 (excluding all administratively Prohibited closure zones). The Conditionally Approved area will consist only of the main channel of Broad Creek between stations 04A and 17B, excluding the closure zones. Between stations 17B and 25, the Conditionally Approved area will consist of Broad Creek proper and adjacent marshes, excluding all closure zones.*

A map indicating the Area 20 Conditionally Approved area boundaries is included in the 2003 Annual Reports

The evaluation period is calendar year 2002. Closure of the Conditionally Approved area was based on rainfall of 1.50" or greater in a 24-hour period. Rainfall is measured at the Broad Creek PSD WWTP.

There is no mariculture activity within this area therefore year-round harvesting is not allowed.

**2. REEVALUATION OF CONDITIONAL CLASSIFICATION**

During the shellfish harvest season, there were two rainfall events greater than or equal to 1.50":

Date	Event	Press Release	Sample Date	Reopening Date
*2-7-02	Statewide Closure Cond. Areas	2-7-02		
	Opened Cond. Areas	2-22-02	2-05-02	2-22-02
9-13-02	Closed Area- Rainfall (1.93")	9-15-02		
	Opened Area	10-04-02	10-02-02	10-04-02

- Rainfall on 2-7-02 was 1.03" which did not exceed management plan criteria (1.50")

**3. COMPLIANCE WITH MANAGEMENT PLAN**

For the evaluation period, the Broad Creek Conditional Management area was managed in accordance with the plan.



**4. COOPERATION OF PERSONS INVOLVED**

Cooperation by Broad Creek WWTP personnel in reporting rainfall events exceeding management plan criteria was prompt. WWTP personnel readily supply necessary rainfall data upon request.

**5. EVALUATION OF WATER QUALITY WITH RESPECT TO THE BACTERIOLOGICAL STANDARDS FOR ITS CLASSIFICATION**

Stations 03, 15A, 04A, 17B, 18, 24, and 25 in Broad Creek currently meet the statistical criteria for Approved classification. However, due to potential water quality variability along with the knowledge that stormwater runoff can have an adverse impact on water quality and public health, these stations have been classified as Conditionally Approved.

For the calendar year 2002, eight samples were collected at each station in the Broad Creek Conditional Area while in the Open status. Analysis of that data indicates all stations in the Conditional Management Area except 24 and 25 meet the statistical criteria for Approved classification. Analysis of sample data for the survey review period (2000 through 2002) was conducted (see attached analysis of data collected following rainfall events  $\geq 1.40''/24$  hours). Excluding sample results that indicated 24-hour rainfall amounts greater than or equal to 1.40 inches on the day of sampling or within 14 days prior to the sample date, the analysis indicates that stations 24 and 25 will meet Approved criteria if managed according to the plan. Therefore, the rainfall amount required to close the Conditionally Approved area in Broad Creek will be reduced from 1.50 to 1.40 inches in a 24-hour period.

Sampling at station 15, Broad Creek at Lawton Creek, was discontinued in November 2002 as the station was located within the administratively Prohibited closure zone for the South Island PSD wastewater treatment plant discharge. Two new stations, 28 and 29, were created in Broad Creek at the Northern and Southern boundaries, respectively, of the closure zone.

**6. RECOMMENDATIONS**

The rainfall amount should be reduced from 1.50 inches to 1.40'' in a 24-hour period and be re-evaluated for the area on an annual basis.

**TABLE #5**

**Special Data Analyses**  
**Conditional Areas Management Plan**

**Shellfish Management Area 20**

## Shellfish Management Area 20

### Monitoring Station #20-03 Excluding Rainfall > or = 1.40", 9/15 thru 5/31

Station	Date	Time	Weather	Wind	Tide	Water	Air	FC.mph	F.C.Log	Salinity	Type	Status	Station: 20-03	
20-03	01/05/00	0826	00	270	2300	13	7	1.9	0.2788	30	R	CAO	<b>Samples:</b>	21
20-03	02/08/00	0813	02	001	2300	8	5	1.9	0.2788	30	R	CAO	<b>Geomean:</b>	3.0
20-03	04/04/00	0746	02	135	2300	19	18	1.9	0.2788	30	R	CAO	<b>Log Avg:</b>	0.4708
20-03	05/09/00	0806	00	180	4300	22	23	1.9	0.2788	28	R	CAO	<b>LogSD:</b>	0.3653
20-03	10/11/00	0754	00	000	2300	20	8	1.9	0.2788	34	R	CAO	<b>Est 90th:</b>	8
20-03	11/27/00	1150	00	001	4200	14	19	2	0.3010	33	R	CAO	<b>Weather</b>	
20-03	12/05/00	0812	00	001	4300	10	1	4	0.6021	32	R	CAO		
20-03	02/14/01	0937	02	001	2100	12	13	1.9	0.2788	36	R	CAO		
20-03	03/28/01	0749	01	045	2300	13	11	1.9	0.2788	34	R	CAO	(00) Clear	(02) Cloudy
20-03	04/04/01	0803	02	001	4200	15	15	5	0.6990	32	R	CAO	(01) Fair	(22) Rain
20-03	05/29/01	0810	02	180	2000	23	25	7	0.8451	32	R	CAO	<b>Wind</b>	
20-03	10/01/01	0814	00	000	2300	19	15	4	0.6021	34	R	CAO		
20-03	11/05/01	0814	01	045	2300	18.0	13.0	2	0.3010	36	R	CAO		
20-03	12/18/01	0809	00	270	2300	17	14	4	0.6021	36	R	CAO	(001) Calm	(135) SE
20-03	01/08/02	0938	00	270	4300	8.0	2.0	2	0.3010	34	R	CAO	(068) Varb	(180) South
20-03	02/05/02	0755	01	045	4200	14.0	2.0	5	0.6990	35	R	CAO	(000) North	(225) SW
20-03	03/13/02	0744	02	135	4000	14.0	13.5	2	0.3010	35	R	CAO	(045) NE	(270) West
20-03	04/17/02	0802	00	001	2100	22.5	23.0	1.9	0.2788	34	R	CAO	(090) East	(315) NW
20-03	05/01/02	0747	02	001	2000	23.0	22.0	70	1.8451	36	R	CAO	<b>Tide</b>	
20-03	10/08/02	0744	02	045	2300	27.0	25.0	1.9	0.2788	32	R	CAO		
20-03	12/17/02	0917	01	045	4100	11.0	10.5	1.9	0.2788	30	R	CAO		
													(2000) Ebb	(4000) Flood
													(2100) 1/4 Flood	(4100) 1/4 Ebb
													(2200) 1/2 Flood	(4200) 1/2 Ebb
													(2300) 3/4 Flood	(4300) 3/4 Ebb

**Water & Air Temps (C)**

## Shellfish Management Area 20

### Monitoring Station #20-04A Excluding Rainfall > or = 1.40", 9/15 thru 5/31

Station	Date	Time	Weather	Wind	Tide	Water	Air	FC.mph	F.C.Log	Salinity	Type	Status
20-04A	01/05/00	0840	00	270	4000	13	7	7	0.8451	30	R	CAO
20-04A	02/08/00	0831	02	001	2300	8	5	1.9	0.2788	30	R	CAO
20-04A	04/04/00	0810	02	135	4000	19	18	13	1.1139	30	R	CAO
20-04A	05/09/00	0821	00	180	2000	22	23	1.9	0.2788	28	R	CAO
20-04A	10/11/00	0814	00	000	2300	20	8	1.9	0.2788	34	R	CAO
20-04A	11/27/00	1218	00	001	4200	14	21	5	0.6990	33	R	CAO
20-04A	12/05/00	0827	00	001	4300	10	1	17	1.2304	32	R	CAO
20-04A	02/14/01	1003	02	001	2100	12	13	1.9	0.2788	34	R	CAO
20-04A	03/28/01	0809	01	045	2300	13	11	13	1.1139	32	R	CAO
20-04A	04/04/01	0821	02	001	4200	15	15	22	1.3424	28	R	CAO
20-04A	05/29/01	0822	02	180	2000	23	25	11	1.0414	32	R	CAO
20-04A	10/01/01	0831	00	000	4000	19	16	5	0.6990	34	R	CAO
20-04A	11/05/01	0831	01	045	2300	18.0	13.0	8	0.9031	36	R	CAO
20-04A	12/18/01	0820	00	270	2300	17	14	5	0.6990	35	R	CAO
20-04A	01/08/02	0954	00	270	4300	8	3	1.9	0.2788	33	R	CAO
20-04A	02/05/02	0810	01	045	4200	14	2	2	0.3010	35	R	CAO
20-04A	03/13/02	0803	02	135	4000	14	14	5	0.6990	34	R	CAO
20-04A	04/17/02	0819	00	001	2100	22.5	23	8	0.9031	34	R	CAO
20-04A	05/01/02	0810	02	001	2100	23	22	23	1.3617	36	R	CAO
20-04A	10/08/02	0806	02	045	2300	27	25	7	0.8451	30	R	CAO
20-04A	12/17/02	0938	01	045	4100	10.5	10.5	2	0.3010	26	R	CAO

**Station: 20-04A**

**Samples:** 21  
**Geomean:** 5.5  
**Log Avg:** 0.7377  
**LogSD:** 0.3802  
**Est 90th:** 16

#### Weather

(00) Clear (02) Cloudy  
(01) Fair (22) Rain

#### Wind

(001) Calm (135) SE  
(068) Varb (180) South  
(000) North (225) SW  
(045) NE (270) West  
(090) East (315) NW

#### Tide

(2000) Ebb (4000) Flood  
(2100) 1/4 Flood (4100) 1/4 Ebb  
(2200) 1/2 Flood (4200) 1/2 Ebb  
(2300) 3/4 Flood (4300) 3/4 Ebb

#### Water & Air Temps (C)

## Shellfish Management Area 20

### Monitoring Station #20-15A Excluding Rainfall > or = 1.40", 9/15 thru 5/31

Station	Date	Time	Weather	Wind	Tide	Water	Air	FC.mph	F.C.Log	Salinity	Type	Status	Station: 20-15A	
20-15A	01/05/00	0836	00	270	4000	13	7	1.9	0.2788	30	R	CAO	<b>Samples:</b>	21
20-15A	02/08/00	0824	02	001	2300	8	5	1.9	0.2788	30	R	CAO	<b>Geomean:</b>	5.1
20-15A	04/04/00	0804	02	135	4000	19	18	1.9	0.2788	30	R	CAO	<b>Log Avg:</b>	0.7076
20-15A	05/09/00	0816	00	180	4300	22	23	8	0.9031	28	R	CAO	<b>LogSD:</b>	0.3927
20-15A	10/11/00	0809	00	000	2300	20	8	1.9	0.2788	34	R	CAO	<b>Est 90th:</b>	16
20-15A	11/27/00	1208	00	001	4200	14	20	17	1.2304	33	R	CAO	<b>Weather</b>	
20-15A	12/05/00	0820	00	001	4300	10	1	7	0.8451	32	R	CAO		
20-15A	02/14/01	0950	02	001	2100	12	13	2	0.3010	35	R	CAO	(00) Clear	(02) Cloudy
20-15A	03/28/01	0803	01	045	2300	13	11	5	0.6990	33	R	CAO	(01) Fair	(22) Rain
20-15A	04/04/01	0814	02	001	4200	15	15	23	1.3617	32	R	CAO	<b>Wind</b>	
20-15A	05/29/01	0817	02	180	2000	23	25	7	0.8451	32	R	CAO		
20-15A	10/01/01	0824	00	000	4000	19	16	2	0.3010	34	R	CAO	(001) Calm	(135) SE
20-15A	11/05/01	0824	01	045	2300	18.0	13.0	11	1.0414	36	R	CAO	(068) Varb	(180) South
20-15A	12/18/01	0816	00	270	2300	17	14	2	0.3010	36	R	CAO	(000) North	(225) SW
20-15A	01/08/02	0950	00	270	4300	8	2	2	0.3010	34	R	CAO	(045) NE	(270) West
20-15A	02/05/02	0803	01	045	4200	14.0	2.0	5	0.6990	36	R	CAO	(090) East	(315) NW
20-15A	03/13/02	0758	02	135	4000	14.0	13.5	5	0.6990	35	R	CAO	<b>Tide</b>	
20-15A	04/17/02	0813	00	001	2100	22.5	23.0	17	1.2304	34	R	CAO		
20-15A	05/01/02	0802	02	001	2100	23.0	22.0	11	1.0414	36	R	CAO	(2000) Ebb	(4000) Flood
20-15A	10/08/02	0756	02	045	2300	27.0	25.0	22	1.3424	30	R	CAO	(2100) 1/4 Flood	(4100) 1/4 Ebb
20-15A	12/17/02	0922	01	045	4100	10.5	10.5	4	0.6021	28	R	CAO	(2200) 1/2 Flood	(4200) 1/2 Ebb
													(2300) 3/4 Flood	(4300) 3/4 Ebb

**Water & Air Temps (C)**

## Shellfish Management Area 20

### Monitoring Station #20-17B Excluding Rainfall > or = 1.40", 9/15 thru 5/31

Station	Date	Time	Weather	Wind	Tide	Water	Air	FC.mph	F.C.Log	Salinity	Type	Status
20-17B	01/05/00	0847	00	270	4000	13	7	7	0.8451	30	R	CAO
20-17B	02/08/00	0839	02	001	2300	8	5	2	0.3010	30	R	CAO
20-17B	04/04/00	0814	02	135	4000	19	18	2	0.3010	30	R	CAO
20-17B	05/09/00	0830	00	180	2000	22	23	13	1.1139	28	R	CAO
20-17B	10/11/00	0820	00	000	2300	20	9	1.9	0.2788	34	R	CAO
20-17B	11/27/00	1230	00	001	4200	14	21	5	0.6990	33	R	CAO
20-17B	12/05/00	0833	00	001	4300	10	1	14	1.1461	32	R	CAO
20-17B	02/14/01	1020	02	001	2100	12	13	2	0.3010	34	R	CAO
20-17B	03/28/01	0814	01	045	2300	13	11	2	0.3010	33	R	CAO
20-17B	04/04/01	0829	01	001	4200	15	15	8	0.9031	30	R	CAO
20-17B	05/29/01	0829	02	180	2000	23	25	7	0.8451	32	R	CAO
20-17B	10/01/01	0840	00	000	4000	19	16	13	1.1139	34	R	CAO
20-17B	11/05/01	0840	01	045	2300	18.0	13.0	4	0.6021	36	R	CAO
20-17B	12/18/01	0827	00	270	2300	17	14	13	1.1139	35	R	CAO
20-17B	01/08/02	1000	00	270	4300	8	3	5	0.6990	34	R	CAO
20-17B	02/05/02	0816	01	045	4200	14	2	2	0.3010	36	R	CAO
20-17B	03/13/02	0814	02	135	4000	14	14	2	0.3010	32	R	CAO
20-17B	04/17/02	0826	00	001	2100	22.5	23	17	1.2304	32	R	CAO
20-17B	05/01/02	0820	02	001	2100	23	22	17	1.2304	36	R	CAO
20-17B	10/08/02	0811	02	045	2300	27	25	11	1.0414	30	R	CAO
20-17B	12/17/02	1013	01	045	4100	10.5	10.5	5	0.6990	25	R	CAO

**Station: 20-17B**

**Samples:** 21  
**Geomean:** 5.4  
**Log Avg:** 0.7318  
**LogSD:** 0.3603  
**Est 90th:** 15

#### Weather

(00) Clear (02) Cloudy  
(01) Fair (22) Rain

#### Wind

(001) Calm (135) SE  
(068) Varb (180) South  
(000) North (225) SW  
(045) NE (270) West  
(090) East (315) NW

#### Tide

(2000) Ebb (4000) Flood  
(2100) 1/4 Flood (4100) 1/4 Ebb  
(2200) 1/2 Flood (4200) 1/2 Ebb  
(2300) 3/4 Flood (4300) 3/4 Ebb

#### Water & Air Temps (C)

## Shellfish Management Area 20

### Monitoring Station #20-18 Excluding Rainfall > or = 1.40", 9/15 thru 5/31

Station	Date	Time	Weather	Wind	Tide	Water	Air	FC.mph	F.C.Log	Salinity	Type	Status
20-18	01/05/00	0851	00	270	4000	13	7	1.9	0.2788	30	R	CAO
20-18	02/08/00	0843	02	001	2300	8	5	1.9	0.2788	28	R	CAO
20-18	04/04/00	0823	02	135	4000	19	18	2	0.3010	30	R	CAO
20-18	05/09/00	0837	00	180	2000	22	23	13	1.1139	28	R	CAO
20-18	10/11/00	0827	00	000	2300	20	9	1.9	0.2788	34	R	CAO
20-18	11/27/00	1235	00	001	4200	14	21	13	1.1139	33	R	CAO
20-18	12/05/00	0839	00	001	4300	10	2	5	0.6990	32	R	CAO
20-18	02/14/01	1029	02	001	2100	12	14	1.9	0.2788	36	R	CAO
20-18	03/28/01	0822	01	045	2300	13	11	2	0.3010	32	R	CAO
20-18	04/04/01	0832	01	001	4200	15	15	11	1.0414	30	R	CAO
20-18	05/29/01	0835	02	180	2000	23	25	17	1.2304	32	R	CAO
20-18	10/01/01	0848	00	000	4000	19	16	5	0.6990	34	R	CAO
20-18	11/05/01	0847	01	045	2300	18.0	13.0	13	1.1139	36	R	CAO
20-18	12/18/01	0831	00	270	2300	17	14	4	0.6021	36	R	CAO
20-18	01/08/02	1007	00	270	4300	8	3	2	0.3010	34	R	CAO
20-18	02/05/02	0821	01	045	4200	14	2	1.9	0.2788	36	R	CAO
20-18	03/13/02	0823	02	135	4000	14	14	2	0.3010	33	R	CAO
20-18	04/17/02	0834	00	001	2100	22.5	23	13	1.1139	32	R	CAO
20-18	05/01/02	0831	02	001	2100	23	22	17	1.2304	36	R	CAO
20-18	10/08/02	0820	02	045	2300	27	25	23	1.3617	30	R	CAO
20-18	12/17/02	1025	01	045	4200	10.5	10.5	11	1.0414	24	R	CAO

**Station: 20-18**

**Samples: 21**

**Geomean: 5.2**

**Log Avg: 0.7123**

**LogSD: 0.4153**

**Est 90th: 17**

#### Weather

(00) Clear (02) Cloudy  
(01) Fair (22) Rain

#### Wind

(001) Calm (135) SE  
(068) Varb (180) South  
(000) North (225) SW  
(045) NE (270) West  
(090) East (315) NW

#### Tide

(2000) Ebb (4000) Flood  
(2100) 1/4 Flood (4100) 1/4 Ebb  
(2200) 1/2 Flood (4200) 1/2 Ebb  
(2300) 3/4 Flood (4300) 3/4 Ebb

#### Water & Air Temps (C)

## Shellfish Management Area 20

### Monitoring Station #20-24 Excluding Rainfall > or = 1.40", 9/15 thru 5/31

Station	Date	Time	Weather	Wind	Tide	Water	Air	FC.mph	F.C.Log	Salinity	Type	Status
20-24	02/08/00	0849	02	001	2300	8	5	2	0.3010	28	R	CAO
20-24	04/04/00	0830	02	135	4000	19	18	2	0.3010	30	R	CAO
20-24	05/09/00	0844	00	180	2000	22	23	5	0.6990	28	R	CAO
20-24	10/11/00	0834	00	000	2300	20	9	1.9	0.2788	34	R	CAO
20-24	11/27/00	1238	00	001	4200	14	22	8	0.9031	33	R	CAO
20-24	12/05/00	0842	00	001	4300	10	2	1.9	0.2788	32	R	CAO
20-24	02/14/01	1036	02	001	2100	12	14	1.9	0.2788	34	R	CAO
20-24	03/28/01	0831	01	045	2300	13	12	5	0.6990	33	R	CAO
20-24	04/04/01	0841	01	001	4200	15	16	17	1.2304	28	R	CAO
20-24	05/29/01	0841	02	180	2000	23	25	5	0.6990	32	R	CAO
20-24	10/01/01	0854	00	000	4000	19	16	8	0.9031	36	R	CAO
20-24	11/05/01	0854	01	045	2300	18.0	13.0	31	1.4914	36	R	CAO
20-24	12/18/01	0838	00	270	2300	17	14	11	1.0414	36	R	CAO
20-24	01/08/02	1013	00	270	4300	8	3	1.9	0.2788	34	R	CAO
20-24	02/05/02	0830	01	045	4200	14	2	5	0.6990	36	R	CAO
20-24	03/13/02	0831	02	135	4000	14	14	5	0.6990	34	R	CAO
20-24	04/17/02	0841	00	001	2100	22.5	23	23	1.3617	34	R	CAO
20-24	05/01/02	0840	02	001	2100	23	22	31	1.4914	36	R	CAO
20-24	10/08/02	0827	02	045	2300	27	25	23	1.3617	30	R	CAO
20-24	12/17/02	1027	01	045	4200	10.5	10.5	8	0.9031	24	R	CAO

**Station: 20-24**

**Samples: 20**

**Geomean: 6.2**

**Log Avg: 0.7950**

**LogSD: 0.4291**

**Est 90th: 22**

#### Weather

(00) Clear (02) Cloudy  
(01) Fair (22) Rain

#### Wind

(001) Calm (135) SE  
(068) Varb (180) South  
(000) North (225) SW  
(045) NE (270) West  
(090) East (315) NW

#### Tide

(2000) Ebb (4000) Flood  
(2100) 1/4 Flood (4100) 1/4 Ebb  
(2200) 1/2 Flood (4200) 1/2 Ebb  
(2300) 3/4 Flood (4300) 3/4 Ebb

#### Water & Air Temps (C)



## Shellfish Management Area 20

### Monitoring Station #20-25 Excluding Rainfall > or = 1.40", 9/15 thru 5/31

Station	Date	Time	Weather	Wind	Tide	Water	Air	FC.mph	F.C.Log	Salinity	Type	Status	Station: 20-25	
20-25	01/05/00	0859	00	270	4000	13	7	8	0.9031	30	R	CAO	<b>Samples:</b>	21
20-25	02/08/00	0853	02	001	2300	8	5	2	0.3010	28	R	CAO	<b>Geomean:</b>	5.3
20-25	04/04/00	0841	02	135	4000	19	19	5	0.6990	30	R	CAO	<b>Log Avg:</b>	0.7240
20-25	05/09/00	0850	00	180	2000	22	23	8	0.9031	28	R	CAO	<b>LogSD:</b>	0.4392
20-25	10/11/00	0842	00	000	4000	20	9	1.9	0.2788	34	R	CAO	<b>Est 90th:</b>	19
20-25	11/27/00	1245	00	001	4200	14	22	7	0.8451	33	R	CAO		
20-25	12/05/00	0848	00	001	4300	10	2	2	0.3010	32	R	CAO	<b>Weather</b>	
20-25	02/14/01	1042	02	001	2100	12	14	2	0.3010	36	R	CAO	(00) Clear	(02) Cloudy
20-25	03/28/01	0840	01	045	2300	13	12	5	0.6990	32	R	CAO	(01) Fair	(22) Rain
20-25	04/04/01	0902	01	001	4200	15	16	5	0.6990	30	R	CAO		
20-25	05/29/01	0849	02	180	2000	23	25	7	0.8451	32	R	CAO	<b>Wind</b>	
20-25	10/01/01	0905	00	000	4000	19	16	5	0.6990	34	R	CAO	(001) Calm	(135) SE
20-25	11/05/01	0906	01	045	2300	18.0	13.0	1.9	0.2788	36	R	CAO	(068) Varb	(180) South
20-25	12/18/01	0842	00	270	2300	17	14	8	0.9031	36	R	CAO	(000) North	(225) SW
20-25	01/08/02	1017	00	270	4300	8.0	3.0	1.9	0.2788	34	R	CAO	(045) NE	(270) West
20-25	02/05/02	0850	01	045	4300	14.0	2.0	2	0.3010	36	R	CAO	(090) East	(315) NW
20-25	03/13/02	0843	02	135	4000	14.0	14.0	1.9	0.2788	34	R	CAO		
20-25	04/17/02	0854	00	001	2100	22.5	23.0	11	1.0414	34	R	CAO	<b>Tide</b>	
20-25	05/01/02	0849	02	001	2100	23.0	22.0	46	1.6628	36	R	CAO	(2000) Ebb	(4000) Flood
20-25	10/08/02	0833	02	045	2300	27.0	25.0	21	1.3222	30	R	CAO	(2100) 1/4 Flood	(4100) 1/4 Ebb
20-25	12/17/02	1029	01	045	4200	10.5	10.5	46	1.6628	22	R	CAO	(2200) 1/2 Flood	(4200) 1/2 Ebb
													(2300) 3/4 Flood	(4300) 3/4 Ebb

**Water & Air Temps (C)**